THE SCIENCE NEWS-LETTER

A Weekly Summary of Current Science

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THE CENTENARY OF BENZENE

By Dr. Edwin E. Slosson
Director, Science Service, Washington

June 16 was the hundreth anniversary of an epoch-making event, the opening of a new era of civilization. Yet it passed unnoticed by the multitude that enjoy its benefits. They went about their business and pleasures as usual; driving motor cars over roads made smooth by coal-tar and level by explosives; they listened to the music of the phonograph or radio; they wore gaily colored clothing, enjoyed pleasant perfumes and aromatic flavors and warded off disease by drugs and ointments without giving a thought of gratitude to the modest man who a hundred years before discovered the mother substance of these comforts, conveniences, and luxuries of modern life, that is, benzene.

For this is one of the silent revolutions of science, originating in a most unspectacular event, plain Michael Faraday, the blacksmith's son, working in the basement laboratory of the Royal Institution in London, separating out from compressed oil gas a few drops of a clear colorless limpid liquid, giving no hint of the potent poisons, brilliant dyes, pungent scents and high explosives that are derived from it.

Benzene is a key compound, we may call it a key-ring compound, for when the chemist draws a diagram of its molecule on the blackboard he makes a ring or hexagon of six carbon atoms, holding hands like half a dozen children playing ring-around-rosy. That is why it gives a chance for so many derivatives. The chemist can attach any kind of atom, or group of atoms, to any of the six carbons and while it makes no difference which of the six he attaches the first side-chain to, it does make a difference where he attaches later side-chains. The chemist has made about 150,000 compounds on the basis of the benzene ring in the century since Faraday discovered it, and he can make as many more if he needs them in his business. All these derivatives are distinct and different, as different as a cat and dog, or as a pot of poison and a pork pie. Most of them are novelties, creations of the chemist, not found in nature. The benzene compounds have added immeasurably to the wealth of the world, to the length of life and to the joy of living.

But the man who first made benzene died poor. He might have made half a million dollars or more if he had turned his talents to commercial work. But he preferred to be a pioneer, and he deliberately set aside the temptations of wealt and title, and devoted his life to the pursuit of pure science. His

professional business income during the later and most fruitful years of his life ranged from $500 a year to zero.

Such a man, whose labors contribute to the enrichment of his country and the world at large, instead of to his own profit, should be supported by the nation, but when Faraday was persuaded to apply to the government for a pension, so he could continue his researches in electricity and chemistry, Lord Melbourne, the prime minister, laughed at him and called him a humbug.

But the world knows him better now than did his rulers, and few will be disposed to dispute the judgment of his friend and collaborator, Tyndall, who said that "Michael Faraday was the greatest experimental philosopher that the world has ever seen."

Faraday announced his discovery of benzene to the Royal Society of London on June 16, 1825, and on thatdate this year delegates of the chemical societies and chemical industries of Great Britain and the United States assemoled at the Royal Institution at London to do honor to this great man and to appraise the value of his discovery to the world.

DARTMOUTH BIOLOGIST FINDS EVOLUTION AN ALLY OF RELIGION

Why I Teach Evolution

By Dr. William Patten,
Professor of Evolution in Dartmouth College.

It is obvious that the outstanding teachings of evolution are the same as the familiar teachings of religion. For the universal reign of law and order, which it has been the special privilege of science to reveal, is nothing more or less than the revelation that Nature is a unified cooperative system, and that those better results, called evolution, are only achieved through better mutual service by all its constituent parts, and by their better submission, or adaptation to one another's requirements. That is the essence of the moral and ethical teachings of Christianity, as it is the essence of the moral and ethical teachings of evolution.

And the law of "Natural Selection", which is the essence of the much maligned "Darwinism", is in reality the expression of a discriminating, selective action in Nature, in effect identical with the discriminating disciplinary laws of religion

This disciplinary natural law merely means that whatever is fitting, or right or true, whether it is physical, or organic, or vital, or spiritual in its nature, shall prevail, and shall yield its appropriate fruits. If it is not fitting, or if it is not right, or not true, it shall be fruitless, and shall not prevail.

In other words, truth has a saving power and a creative compulsion of its own. We call it the compulsion of intelligence. That is <u>why</u> man is compelled to seek the truth and to use it for his own salvation and betterment. And the <u>doing of that</u> is what we call science. But if we do not use the truth when it is discovered, if the truth when it is discovered does not make us work and direct our work, if it is not reverified in terms of human conduct, science will be sterile; it will neither bear its appropriate fruit nor have the vitality of reality.

Thus this compelling pragmatic law, which Darwin so clearly saw in operation in plant and animal life, and which he called "Natural Selection", is the same law that is so clearly expressed in biblical teachings as for example:

"And even now the axe is laid unto the roots of the trees: therefore every tree which bringeth not forth good fruit is hewn down and cast into the fire. But the root of the righteous shall not be moved."

And so, if we attempt to summarize the creative methods of evolution and to estimate their directive influence on ourselves, physically and mentally, it is not surprising that the narrower terminology of science inevitably changes into the broader moral and ethical terminology of idealism, or religion, or into that of any real creative process, such as art, business, or politics.

This means that in the last analysis religion is merely a different name for science; the one being chiefly concerned with the immeasurable Oneness, or Godliness of Nature-action, the other with its measurable Manyness, or its distinguishable parts. But both seek to discover, to interpret, and to utilize the same realities; and when that is rightly done they will be in ethical agreement; that is, they will dictate to mankind essentially the same conduct and justify essentially the same faith.

Thus science and religion offer the same incentives to action and have the same purposes to accomplish; and science expressed in her more comprehensive formulas precisely what all the great religions of the past and present have tried to express in their teachings, but without that sure and intimate knowledge of Nature-action which science gives us, and which is so essential to the truthfulness and sanity of any kind of religion.

I repeat, there is no difference between what is vital in science and what is vital in religion. In fact, underneath, science <u>is</u> religion, and religion <u>is</u> science. The differences which cause so much confusion are in their protective coverings of dogmas, ceremonials, and procedures. They are differences between people; between those with more or less scientific qualities of mind and those who have little or no such qualities.

And so, it seems to me, that the study of evolution, <u>as a whole</u>, more than anything else, will help to minimize the antagonism between religiously minded and scientifically minded people, and will help them to work more peacefully and happily together. For young and old, for high-brow and low-brow, the study of evolution makes life more significant and more beautiful. It justifies their faith and fortifies their ideals. It makes God a more imminent reality. It helps all of us to understand the purpose of life, and how to accomplish it.

That is why I teach evolution.

SCIENTISTS STUDY WEAR ON KITCHEN TOWELS

Chemical and microscopic tests made by Katherine Taylor Cranor and Ida Belle Dorsey of the Iowa State College have at last settled the vexing question of what kind of kitchen towels last longest. These tests show that you can not tell by looks. Union and cotton towels stand harder wear than linen towels, although they did not wash out so white or so easily.

BLOOD REACTIONS SHOW RELATION OF MAN AND ANIMALS

By Dr. Michael F. Guyer,
Professor of Zoology, University of Wisconsin

Since Darwin's day important new evidence of evolution has been discovered, based on certain blood tests which give a scale of rel tionships among various groups of animals.

Some years ago Reichert and Brown showed that in different kinds of structurally related animals the corresponding proteins and other vital substances of the different species exhibit chemically the same degree of relationship as that indicated by their position in the zoological scheme of classification. Thus, when the red coloring matter of the blood is reduced to crystalline form in blood from different kinds of backboned animals, although each species has its own individual type of crystal, the crystals of all species belonging to the same genus fall within the same crystallographic system, and generally within the same group in that system. Reichert, furthermore, has shown chemical relationships of the same general nature in the starches and tissues of parent plants to those of the hybrids between such plants. In other words, the more nearly related in classification different kinds of plants or animals are, the more nearly identical they are in their underlying chemical constitution. Such a condition is exactly what would be expected if the forms in question have evolved from a common ancestry.

But an even more convincing demonstration of evolutionary relationships is to be found in the reactions of the blood-serum of animals under certain conditions. When into the bloodstream of a given animal, for example, protein from an animal of different species or from a plant is injected, the animal so treated will have antagonistic or neutralizing substances of various kinds termed antibodies developed in its blood. Thus poisons called toxins, derived from bacteria, produce antitoxins. Invading bacteria also lead to the production of sticky substances which clump bacteria of the kind used in their production if the two are brought together in the blood-serum of the animal into which the bacteria were originally introduced. Likewise a tissue or even the blood-serum of one kind of animal injected into the circulation of another animal of different species brings about the formation of a class of antibodies known as precipitins. These form a white precipitate when the blood-serum of the treated animal and an extract of the special tissue used are brought together in a test tube. All such immunological reactions show considerable degree of specificity; the antibody will react fully only with the particular kind of protein used in its production.

In a remarkable series of studies in which he examined the blood from 900 different animals, Nuttall demonstrated some twenty years ago that by the precipitin test a scale of actual blood relationships among animals can be established. Recent refinements of the method together with the employment of other types of blood reaction all tend to confirm his conclusions. If, for example, a rabbit has been repeatedly injected with human blood, its blood-serum when mixed with slightly diluted human blood-serum in a test-tube will almost instantly yield a noticeable precipitate, although a control mixture of human blood-serum and the blood-serum of an untreated rabbit will remain clear. Closeness of relationship is determined by finding the dilution in which the serum tested will react. For instance, Nuttall found that when rabbit-serum which earlier had been treated with human blood-serum is mixed with moderately diluted blood-serum of man, apes and monkeys respectively, it reacts to all, though in varying degree

When mixed with more highly diluted sera from such animals it forms a precipitate only with the serum of man and the manlike apes (chimpanzee, orang-outang, gorilla). the chimpanzee standing nearest to man.

Thus the chemical and other physiological processes of living organisms no less than their anatomical structures or geological history point to a relationship of various species which is intelligible only upon the inference that such species have sprung from a common ancestry.

PREHISTORIC MISSING LINK SUSPECTED BY RUSSIAN ACADEMIST

A missing link in the prehistoric past of the reptiles is brought to the attention of American scientists by Dr. Peter B. Sushkin, of the Russian Academy of Sciences, who is now examining specimens at leading museums in the United States.

The prevailing theory is that the family tree of the reptiles can be traced back through the amphibians, which are at home both on the land and in the sea, and thence back to fish-like ancestors.

"But," says Dr. Sushkin, "the amphibians so far found do not fit into this diagram. All amphibians known are in some respects more advanced than reptiles, and so cannot be considered their ancestors. I find such evidence in the Russian material, and nothing contrary to the theory is shown in the material which I have seen in museums of the United States."

The evidence indicates that amphibians so far known represent only a side branch of development, Dr. Sushkin believes.

"These arguments," he explains, "are based on the relations between the ossicles, which are small bones of the ear, and the quadrate, a bone supporting the under jaw, and on the structure of these bones. In the fish and in the principal reptiles, the bone which corresponds to the ossicle is directly connected with the quadrate. In the known amphibians, the connection has already been broken, indicating that they had progressed to an advanced stage."

The amphibians which the Russian academist has been studying were somewhat like the frogs of today, except that they were much larger, some being ten or fifteen feet long. They hatched their eggs under water and the young lived and breathed under water until lungs formed in their bodies, after which they could breathe only in the air. Reptiles, even those that live in water, are altogether air breathing creatures.

The prehistoric amphibians belong to the Permian age, which geologists place 25 or 30 million years ago in the earth's history. They are thus older than the oldest animals so far discovered, as the earliest mammal finds belong to the Triassic period, which was about 20 million years ago. The earliest man whose bones have been found, pithecanthropus erectus, dates back only a million years.

Dr. Sushkin says that there are many gaps in the past history of the earth's creatures, but wonderful progress has been made considering that most of the paleontological research has been done in the past 40 years, and only a small part of the earth's surface has been scratched.

CROPS OBSERVED FROM AIRPLANE

Agricultural observers are trying the plan of going up in the air in order to find out quickly and accurately what is happening on the earth. A test flight, in an army plane, has just been made over the fields of North Carolina, with a view to determining the practical possibilities of this method in surveying crop conditions.

The plane flew over a 200 mile area producing cotton, tobacco, peaches, and other important crops, at a height of from 500 to 2,000 feet; and an agricultural statistician in the service of the U. S. Department of Agriculture noted with unassisted eye the extent of damage done by insects or storms, and the general healthiness of the crops. No attempt was made to estimate the acreage yield of the fields in this test.

Mr. Charles E. Gage, administrative officer of the U. S. Office of Crop and Livestock Estimates, says that an observer in a n airplane could cover hundreds of miles in a day and arrive at reasonably accurate conclusions as to the state of the crops. No Sherlock Holmes microscope is needed to show the ravages of insects, or of wind, rain, or drought. A cotton field that is a dark , healthly green has obviously escaped weevil attack. Another field that is moderately infested will be of a lighter color, and a field that has fed a huge army of hungry weevils may be left entirely bare of foliage. The color of the soil shows an air observer whether land is suffering from drought or is plentifully supplied with moisture.

A quick means of reporting on the state of growing crops might prevent some disturbance of market prices due to guesses and rumors, Mr. Gage believes, "After a big storm," he says, " reports of damage are apt to be exaggerated. And sometimes there is difficulty in finding out the truth be cause trained crop observers may not be available or transportation may be interfered with by washouts or bad roads.

"The ordinary method of finding out the condition of the crops in a state is to send out questionnaires to farmers and then to tabulate the answers received. In the case of a severe storm, special questionnaires may be quickly sent out, supplemented by reports from trained observers who travel through the region by automobile or train.

"By such means it takes not less than ten days to get a conservative estimate of damage, whereas an airplane observer might report on a large area within a few hours."

The average department store in the United States sells out completely three and a third times in a year.

American apples are popular in Egypt and are preferred to those received from Italy, Greece and Turkey, but the farthest away look the best and Australian apples are offering keen competition.

Volcanic ash is used in making scouring soaps, abrasives, and similar products.

NEW METHOD OF FINDING NORTH HELPS SURVEYORS

Observations of stars near the pole star will be used by surveyors to find the true north, if a new method invented by Howard R. Ward, and reported to Engineering and Mining Journal-Press, is adopted. Formerly, when a surveyor or engineer desired to find the true north, it was necessary to sight his transit instrument on Polaris, the pole star, when it was exactly above or below the true pole, which is a short distance away from it. As it is only in this position twice during a day, and usually only once during a night, it is often necessary to wait several hours before this situation occurs. Mr. Ward's method, however, permits observations at any time. It depends on observations of the pole star and one of two other stars, Alkaid, the star at the end of the handle of the Dipper, and Epsilon in the constellation of Cassiopeia. The second star observationis made a few minutes after that of the pole star, the exact time interval being furnished by a table. A simple computation then gives the distance that the telescope of the instrument must be moved to have it point to the true north. This method may also be used to determine latitude, says Mr. Ward.

SAFETY OF STEEL ROPES MAY BE TESTED BY MAGNETISM

Steel girders and cables that appear to be perfect but that contain dangerous hidden flaws will no longer deceive engineers and menace public safety when one more of nature's mysteries has been fully probed.

Magnetic analysis is the method that promises so much in the way of searching out defects in steel. For two years, the U. S. Bureau of Standards has been working with this method, in the hope of making it practical and thus providing a more searching test for elevator cables than the usual visual inspection. As Congress has made no appropriation for the work for the coming year, an advisory committee of engineers, physicists, manufacturers, and insurance experts interrested in the tests will meet here this month to hear a final report of what the government has accomplished in this important field.

R. L. Sanford, physicist at the Bureau of Standards, says that magnetic analysis meets all of the requirements for a practical non-destructive test of steel, except for the fact that as yet the results of a test cannot always be interpreted accurately. The method is simple, rapid, and inexpensive.

"The basis of the magnetic tests," Mr. Sanford explains, " is that changes in mechanical qualities of steel are found to be accompanied by corresponding changes in the ease with which the material can be magnetized.

"In the method under investigation, a photographic record is made of the magnetic quality of a specimen. of steel wire along its length. Uniformity of properties is indicated by a straight line record. This indicates absence of flaws. Irregularities in magnetic quality are revealed by corresponding irregularities in the record. Defects in the material cause such irregularities. The difficulty is that other causes which do not impair the strength of the steel may also, mysteriously, produce an irregular record. A flaw was indicated in one bar of steel, and we broke it and found the flaw. But in several other tests similar reactions were noted, and when the bars were broken no flaws were found. The present problem, therefore, is to discover the key to the interpretation of the magnetic records."

Mr. Sanford says that when the principles of magnetic analysis are fully understood it should be possible to test a steel girder or a cable before it leaves the factory, and again when it is put in place, and whenever its safety is questioned.

The Bureau of Standards may continue the experiments in a limited way from its regular funds.

AMERICAN BANANA ORIGIN ATTACKED AS WILD MYTH

In a scathing denunciation of what he termed the great American banana myth, Dr. W. E. Safford, economic botanist of the U. S. Department of Agriculture, attacked evidence recently brought forward in support of the theory that bananas originated on this hemisphere and were cultivated by prehistoric Indians.

Commenting on the discovery of fossil banana seed in coal beds of Colombia and the connection of this discovery with statements made by early writers as to the Indians' use of the fruit, he declared positively that the home of the banana was in the Malay archipelego, that it was unknown in America when Columbus reached here, and that the same writers who reported it as native to the New World demonstrated similar ignorance in regard to the potato and other plants.

Fossils show that there were horses, camels, and elephants in North America ages ago, but there were none here when the Spaniards reached this hemisphere, he said. Fossil banana seed can prove nothing in regard to American banana trees, for our bananas do not have seed. They must be propagated vegetatively from cuttings.

Columbus and his followers listed the plants which they encountered, but made no mention of the banana. Bananas were introduced into the West Indies from the Canary Islands by Padre Tomas de Berlangas in 1516. They were also carried to Pacific Islands by early migrants; but their native home was in the Malay archipelago.

The persistence of the myth of the American origin, Dr. Safford declared, was due to the great Humboldt, who evidently was not himself a botanist, and accepted the statements of Carcillaso de la Vega, a descendant of the Incas, who claimed in the early sixteenth century that bananas were a staple food of South American Indians in pre-Columbian times. This man, Dr. Safford said, was ignorant of the agriculture he pretended to describe. Most of his information was secondhand and his exaggerated and unreliable statements lack confirmation. Homboldt also accepted statements that the Irish potato was found in Virginia by early colonists when it has been definitely established that it was a native of Peru abd was unknown in North America before the coming of the white man.

The importation of secondhand clothes in Costa Rica is strictly prohibited and all such arriving after June are to be burned, but travellers wearing last year's things are allowed in after the usual inspection.

Waste molasses may be used to make alcohol for motor fuel in Australia on a large scale, according to plans under consideration there,

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MENTAL PROFILE SHOWS INDIVIDUAL'S FUTURE

A vocational expert should carefully study an individual's entire mental profile before advising him to enter any line of professional work, Dr. L. L. Thurstone told the conference on vocational guidance held by the Personnel Research Federation in Washington. The mental profile shows the individual's intelligence curve, that is , the definite points in which he ranks high and those in which he ranks low.

"The professions are complex,"Dr. Thurstone pointed out. "In the field of engineering, for instance, I believe it is possible to find men who have every combination of traits imaginable. There are even successful engineers who hate mathematics, and such persons would be likely to be warned away from engineering by a vocational expert unless he closely analyzed mental capacity and unless he understood the requirements of the different branches of the profession."

CALIFORNIA HAY FEVER BLAMED ON BERMUDA GRASS

Devil-grass, the curse of California lawns, has been indicted for misdemeanor on a new count. Hay-fever is the trouble this time, according to Dr. George Piness of Los Angeles, whose extensive researches on diseases from protein irritation lead to the conclusion that Bermuda grass- or "devil-grass", is possibly the worst hay-fever offender in the state. In this investigation the human skin is tested with a liquid extract of pollen in a manner suggestive of vaccination.

California fortunately does not harbor the notorious eastern ragweed, the curse of so many eastern hay-fever victims, and for such special cases is a haven of refuge. However, a different class of people develop a sensitiveness to the pollen of Bermuda grass. The irritation rises to a climax when the family lawnmower chops and throws up the pollen-laden flowering heads of the grass. Many unwitting victims sneeze their way through such experiences, blaming dust, germs, colds or bad luck in general.

The California resident likes to have a year-round green lawn, perfectly attainable with Kentucky blue grass, which will stand the mild frosts of a western winter. Bermuda grass, however, invariably seeds itself into such a lawn, chokes out the Kentucky grass by a vigorous summer invasive growth, and then dies down to a sickly brown with the first touch of cold weather. So far it seems to be a fine example of the ill wind that blows nobody good.

WORLD'S LARGEST BOILER INSTALLED IN PITTSBURGH

What is said to be the largest steam boiler in the world is now being installed in this city by a company which supplies heating service in the downtown business district. There are six miles of 4-inch steel tubing in the heating and condensing tubes of this apparatus with a heating surface of 32,750 square feet, about three-fourths of an acre. The boiler is rated at 3000 horse power by the ordinary system of rating, but is capable of operating continuously at three times this capacity and for short periods at four times this rate. When at full load it evaporates 200 tons of water per hour.

COOK ROBS VEGETABLES OF VALUABLE MINERALS

Minerals needed in the building and working of the human body are removed from many vegetables by cooking, and Profs. W. H. Peterson and C. A. Hoppert of the University of Wisconsin have discovered that the best way to avoid such loses is to cook by steam.

In elaborate tests of sixteen vegetables to determine just how much calcium, phosphorus, and iron, the minerals most likely to be deficient in the average diet, was removed by different methods of cooking they found that cabbage, celery, beet greens and onions suffer great mineral losses. Spinach, however, showed a complete and unlooked for retention of its calcium.

When boiling must be employed, they advise using the minimum quantity of water and making soups and gravies out of the residue when possible.

TABLOID BOOK REVIEW

CONCERNING THE NATURE OF THINGS
By Sir William Bragg. New York: Harper and Brothers. $3.00

Last summer when the British Association for the Advancement of Science met at Toronto I went to one of Sir William Bragg's famous lectures to young people in the hope of discovering the secret of his success in the popular presentation of science. I discovered the secret - but it was nothing anybody else could borrow for it was the charm of his own personality, his candor and clear thinking, his breadth of knowledge and command of language.

This charm he has largely carried over into the printed book in which he describes his own investigations on crystals and modern views on the structure of matter. Not since Faraday and Tyndall has a physicist of the first rank shown such ability to translate recondite researches into the language of the people. Here the non-technical reader can get for the first time a comprehensible explanation of such everyday questions as why graphite is greasy; how a gull or an rplane flies; why a golf ball curves; why a diamond is hard; how ice freezes snowflakes fall; how an electric current is conveyed through a wire; and how ering alters steel.

Edwin E. Slosson

United States now produces about 96 per cent. of the dyes used in this

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e summer, herds of musk-oxen graze in flower-filled valleys of Elles-d, the second nearest known land to the North Pole.

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t powerful lighthouse in the world has been erected on a mountain top France, to serve as a check on location and direction for airplanes.

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(By Science Service)

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DO YOU KNOW THAT -

New Bedford, Mass., is the only city in the United States with a population of a hundred thousand or more where no fatal automobile accident has occurred this year up to May 23.

There are about a half million different sorts of living creatures on earth and more than three-fourths of these are kinds of insects.

The daily average supply of water used in London amounts to 36.15 gallons per inhabitant.

Crushed rock salt is the best chemical to use in killing the common barberry which spreads the black stem rust of cereals.
